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# Digital technology adoption and the performance of micro, small and medium enterprise firms in Kenya. implications for informal sector engagement

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**Abstract**
The COVID-19 pandemic had negative effects on the financial performance of micro, small and medium enterprises, particularly those operating within the informal economy. This forced the firms to rethink their business models in order to survive and compete with firms in the formal economy. In response, a significant number of micro small and medium enterprises adopted digital technologies to facilitate business continuity and raise their resilience against shocks similar to COVID-19. While existing literature acknowledges the critical role of digital technology in enhancing the performance of micro, small and medium enterprises, there exists scanty literature examining its impact on the performance of micro, small and medium enterprises in Kenya. This study therefore uses micro, small and medium enterprise 2016 survey data to estimate the effect of digitalization on the performance of micro, small and medium enterprises in Kenya. On using propensity Score matching method, the study finding show that micro, small and medium enterprises that adopt digital technology realize KES 7.55 million more than one that has not adopted. Based on this finding the study makes the following recommendations. First, there is need for the government of Kenya to implement targeted programmes to support MSMEs. One of the targeted programmes is training MSMEs on how to use digital technologies. Secondly, the government should invest in a reliable internet and affordable ICT infrastructure particularly in rural areas.

**Keywords:** Micro, small and medium enterprises, digital technology adoption, performance, kenya

## Introduction

Micro, Small and Medium Enterprises (MSMEs) are widely recognized as critical drivers of economic development, employment creation and poverty alleviation (World Bank, 2019) [32]. In Kenya, MSMEs account for approximately 98 percent of all businesses and are central to the attainment of Kenya's vision 2030, which aims to transform Kenya into a newly industrialized middle-income nation. Defined as enterprises with between 1 to 99 employees, Kenyan MSMEs are a source of livelihood to about 15 million people both directly and indirectly. As of 2021, there were about 7.41 million MSMEs in Kenya, of which only 1.56 million were registered and licensed while 5.85 million operated in the informal economy. Collectively these enterprises generated an output valued at Kshs. 3,369 billion, which accounted for 4 percent of the national Gross Domestic Product (GDP), with a Gross Value Added (GVA) of about Kshs. 1,613 billion compared to the national GVA of approximately Kshs. 5,668 billion (Mwakio, 2024). While MSMEs in the informal sector constituted about 79 percent of all MSMEs, they contributed only about 10 percent of the total GVA generated by MSMEs which highlights a performance gap in the informal sector.

Kenyan MSMEs continue to face persistent challenges that constrain their performance and growth despite their socio-economic performance. Past statistics indicate that nearly 70 percent of MSMEs in Kenya fail within their first three years of operation (Douglas *et al*., 2017) [8]. In concurrence, national data from the 2016 Micro, Small and Medium Enterprises (MSMEs) survey conducted by the Kenya National Bureau of Statistics (KNBS) revealed that approximately 2 million enterprises had ceased operations over the preceding five years, with about 46 percent of these MSMEs closing within their first year of operation primarily due to low profitability (Republic of Kenya, 2016). Moturi & Nyaboke, (2018) [21] attributed the high failure rates to the low Information and Communication Technology (ICT) uptake, which in turn constrains their operational efficiency thus constraining their overall performance.

These challenges were further intensified by the Covid 19 pandemic, which caused unprecedented global disruptions not only to the public health systems but also to economic structures (Ouyang, 2023) [23]. What started as a health crisis turned into a prolonged socio-economic crisis affecting the functionality of the MSMEs, especially those in the informal sector (Erdiaw-Kwasie *et al*., 2023) [9]. These enterprises faced significant operational challenges due to government imposed lockdowns and mobility restrictions. As a result, many MSMEs had to rethink and revise their operational frameworks and adopt more resilient strategies to ensure continuity and remain competitive. Many MSMEs adopted digital technologies, such as mobile money platforms, which allowed them to continue transactions even during periods of disruption.

According to Vial (2019) [31], digital technology adoption is defined as the process by whichindividuals, firms and institutions integrate digital tools into their operations to enhance overall efficiency. In this era of digital revolution, adoption of digital technology has become indispensable for businesses seeking to expand their market reach, enhance customer engagement and increase sales (Pascucci *et al*., 2023) [25]. By adopting digital technologies MSMEs can now operate with contactless, secure and efficient payment system, which has become an essential adaptation strategy.

However, despite the irrefutable advantages of mobile money services, the adoption of platforms such as M-Pesa, within the informal sector remains limited. According to the Republic of Kenya (2016), only about 37 percent of informal enterprises reported using M-Pesa for business transactions compared to over 70 percent adoption rates in

the formal sector. This disparity may be attributed to various factors. According to Paesani & Del Torso (2018) [24], limited digital literacy among informal enterprise proprietors constrains their ability to fully utilize mobile money features such as M-Pesa business tills and Lipa na M-Pesa services. Additionally, many informal businesses are unregistered, which limits their access to special financial services designed for businesses (Distinguin *et al*., 2016) [7]. Further concerns revolve around data security and privacy which also hinder wider adoption (Mbogo, 2010) [19].

Digital technology adoption has been identified as a key determinant of the performance of MSMEs. Existing literature highlights a positive and significant relationship between digital technology adoption and MSMEs performance across both developed and developing economies (Jack & Suri, 2014) [11]. Empirical evidence suggests a strong correlation between digitalization and financial performance metrics such as revenue growth, profitability, and return on assets (Kidschun, 2024) [12]. However, the benefits are contingent on complementary capabilities such as digital literacy, strategic orientation, and leadership commitment (Kraus *et al*., 2022) [15]. In Kenya, digital technology has demonstrated significant potential to enhance the performance of informal MSMEs by facilitating access to new markets. A study by Matarazzo *et al*. (2021) [17] showed that

businesses using digital technologies tend to grow, perform, and compete better than those that do not adopt such technologies. This was further evidenced during the COVID-19 pandemic when Kenyan MSMEs that embraced digital tools had a 25 percent higher chance of survival and saw a 30 percent increase in revenue compared to those that did not as documented by the Republic of Kenya (2022).

Despite the growing evidence on the benefits of digital technologies, there is still limited research on how it affects MSMEs performance in Kenya. Most existing studies have primarily focused on formal MSMEs leaving a knowledge gap concerning how digital technology adoption influences performance in the broader MSME sector as documented by (Chege *et al*., 2019) [6] and (Thuo, 2022) [30]. This study seeks to fill the gap by examining the impact of digital technology adoption on the performance of MSMEs in Kenya. In doing so this research contributes to the growing body of literature providing evidence to guide policy makers in designing digital adoption strategies tailored to the entire MSME sector in Kenya.

## Literature Review

Existing literature highlights the role of digital technologies in enhancing business performance and continuity while building resilience to economic shocks particularly in the wake of disruptions such as Covid 19 pandemic (Bouwman *et al*., 2019) [4]. Several studies have investigated digital technology adoption and performance of MSMEs across both developed and developing countries.

For instance, OECD (2021) [22] conducted a comparative study on digital adoption among MSMEs across 35-member states. Drawing from survey data of over 10,000 MSMEs, the study assessed digital technology use, innovation capacity, and productivity levels. Findings showed that SMEs using digital tools reported about 30 percent increase in profitability. However, the study focused on formal MSMEs in high income countries. The current study adds to this body of knowledge by examining MSMEs in a low- and middle-income country.

Dimoso &Utonga (2024) conducted a systematic review of digital technology adoption in MSMEs and its implications for performance in developing countries. Drawing on peer-reviewed

literature published between 2017 and 2023, the study findings revealed that digital technology adoption positively impacts MSME performance across the operational, financial, market, and customer relationship dimensions. However, the study lacks country specific analysis. Therefore, the current study builds on this gap by conducting an analysis specifically focused on Kenya's MSME sector.

In Sub-Saharan Africa, empirical studies show consistent evidence of digital technologies contributing positively to MSMEs performance. Adjabeng & Osei (2022) [2] observed that Ghanaian MSMEs using digital tools such as mobile banking and online marketing exhibited higherprofitability and customer acquisition rates. Adebayo, Adesoba, &Kayode (2024) [1]

Investigated the impact of digital technology adoption on MSMEs performance in the Food, Drink and Beverages industry in Ondo State, Nigeria. Utilizing data from 350 MSMEs analyzed through descriptive statistics and ANOVA, the study revealed that digital technology adoption has positive and significant impact on the financial performance of selected Food, Drink and Beverages MSMEs in Ondo State, Nigeria. However, the study is sector-specific while its limited geographical scope limits the generalizability of the findings.

In Kenya, a growing body of literature affirms the positive relationship between digital technology adoption and the performance of MSMEs. Thuo (2022) [30] examined the effect of technology on the performance of MSMEs in Starehe Sub-County, Nairobi. Utilizing a descriptive research design and data from 108 selected MSMEs, key findings showed that technology adoption had a significant relationship with MSMEs performance, explaining about 29 percent of the performance variation. However, the study was limited to formal SMEs in one urban area. The current study builds on this by focusing on both formal and informal SMEs operating across different regions in Kenya. Chege *et al*. (2019) [6] explored how digital technology innovation affects MSMEs performance in Kenya. Using a sample of 240 MSMEs in Tharaka Nithi county and structural equation modeling the findings revealed a positive relationship between digital technology adoption and firm's performance. However, the study's narrow geographic focus and emphasis on formal businesses present limitations in generalizability of the findings to the broader MSMEs sector.

## Methodology

### 1. Methods of Data Collection

The study utilized secondary data. Cross section data from the Micro, Small and Medium Enterprise (MSMEs) 2016 survey was considered for analysis.

### 2. Estimation Technique

The study used the Propensity Score Matching (PSM) to estimate the effect of digitalization on performance of msmes.

## 3. Model Specification

In order to estimate the effect of digitalization on performance of MSMEs, the following regression model is specified: Where perform represents performance, the dependent variable measured by sales turnover, digital represents digitalization, the independent variable measured by a dummy variable taking the value 1 if the firm received mobile payments and zero otherwise. With respect to control variables, we include to represent access to electricity. Controlling for access to electricity was informed by the fact that electricity is a key infrastructural constraint and can have a direct effect on a firm's productivity (Handayani, Nasrudin & Rezki, 2024) [10]. The study also controlled for education of the owner of MSME. Education is a proxy for human capital, which is regarded as a significant factor in stimulating innovation activities thus leading to high sales turnover (Leiponen, 2005; Schneider *et al*., 2010) [28].

However, since selecting a firm into digitalization is not randomized, establishing a cause effect relationship with adoption of digitalization require one to control for adverse selection. In order to reduce selection on observables, the study adopted PSM method which is built on the conditional probability of adopting digitalization given certain covariates. The covariates are illustrated in equation 1. Estimating propensity scores relied on the availability of the mentioned

covariates in MSME 2016 data. This reduced the bias brought about by the differences in the observed covariates therefore balancing the covariates between the firms that embraced digitalization and those that did not. After applying the multiple regression in the estimation of (PS) and attaining the balance of PS between the firms that had embraced digitalization and those that had not embraced. The aim was to estimate Average Treatment Effect (ATE), that is, the effect of digitalization. ATE is obtained as a difference in the mean response for those frims that had embraced digitalization and those not. The ATE is illustrated in equation 2.

Where n is number of firms, $Y_{1i}$ is the outcome for those that used mobile payments and $Y_{0i}$ is the outcomes for those that did not use mobile banking. However, equation 3 cannot be estimated since both $Y_{1i}$ and $Y_{0i}$ cannot be observed for every firm. In addition, since the study is an observational one, there is a high probability that the outcome of study's interest, that is, the using mobile payment depends on a treatment thus leading to a biased ATE. The study thus uses the obtained PM to estimate the causal relationship of digitlazation. Specifically, the study estimated and reported the Average Treatment Effect on Treated (ATT), that is, the average response to the treatment (embracing digitalization). From the ATE equation illustrated in Equation 3, the study estimated the ATT as shown in Equation 3.

Where W is a vector of the covariates and Z is the concerned treatment, embracing digitalization in this case. The estimation of ATT is anchored on the following assumptions (Morgan & Winship, 2007) [20]. First is that there is a stable unit treatment value assumption (SUTVA). This means that the treatment applied to one entity does not affect the outcome of any other. In other words, we mean there is no interference among the firms. The second assumption indicates the presence of non-zero probability in obtaining every treatment level, embracing digitalization in this case for the combination of the exposure values and the covariates among elements in the study population, MSMES in this case. This is called the positivity assumption. This assumption is made when each of the homogeneous elements can be subjected to treatment (embracing digitalization) or the control group (those that didn't embrace digitalization). The last assumption

Is that the treatment assignment mechanism is said to be unconfounded if the treatment status is conditionally independent of the potential outcomes, given a set of covariates. This is represented as illustrated in equation 5.

These assumptions made it possible for the construction of the matched digitalization samples. This was built on a balancing score, that is the PS (Rosenbaum & Rubin, 1983) [27] and the estimation of the relationship of adopting digital technology by kernel, stratification and the nearest neighbour matching. Inverse probability weighting (IPW) was also conducted since this was an observational cross-sectional study with one treatment variable (Bender and Lange, 2001) [3].

## Results

### Summary Statistics

The characteristics of the MSMEs are presented in Table 1.

**Table 1:** Summary Statistics

| Variable | Obs | Mean | Std. Deviation | Min | Max |
|---|---|---|---|---|---|
| Digitalization | 2662 | 0.595 | 0.491 | 0 | 1 |
| Sales | 1823 | 10.427 | 59.695 | 0.001 | 920 |
| Access to Electricity | 2662 | 0.915 | 0.279 | 0 | 1 |
| Primary Education | 2476 | 0.250 | 0.431 | 0 | 1 |
| Secondary Education | 2476 | 0.270 | 0.444 | 0 | 1 |
| Tertiary Education | 2476 | 0.267 | 0.443 | 0 | 1 |
| Graduate | 2476 | 0.217 | 0.412 | 0 | 1 |

**Source:** Computations of the author based on data from MSME 2016 data

From Table 1 it is evident that about 49 percent of MSMEs have adopted digital technology through establishing a platform for mobile payment. In addition, the sampled MSMEs realize sales turnover of KES 10 million on average per annum. The results also revealed that about 92

percent of the MSMEs have access to electricity. According to Republic of Kenya (2014), the high access to electricity can be attributed to reduced cost of the electricity in the country. The results also revealed that out of 2476 owners of the MSMEs, those with secondary education were the highest translating to 27 percent. According to Carmichael, Darko, & Kanji (2021) [5], this finding can be attributed to the fact that secondary schools in Kenya emphasize on theoretical and not practical skills that can make one to be absorbed in formal employment. This means the secondary school levers have to resort to the MSMEs for survival.

On sorting summary statistics by those that are using mobile payments or not the statistics in Table 2 was obtained. A question was posed on whether an MSME was using mobile money Platform in the establishment or not.

**Table 2:** Summary statistics by Adoption of Digital Technology

| Group | Variable | N | Mean | Std. Deviation | Min | Max |
|---|---|---|---|---|---|---|
| No | Sales | 755 | 6.265 | 42.912 | 0.001 | 920 |
| | Electricity Access | 1077 | 0.896 | 0.305 | 0 | 1 |
| | Primary Education | 994 | 0.313 | 0.464 | 0 | 1 |
| | Secondary Education | 994 | 0.273 | 0.446 | 0 | 1 |
| | Tertiary Education | 994 | 0.242 | 0.429 | 0 | 1 |
| | Graduate Education | 994 | 0.171 | 0.377 | 0 | 1 |
| Yes | Sales | 1068 | 13.369 | 69.013 | 0.001 | 900 |
| | Electricity Access | 1585 | 0.928 | 0.258 | 0 | 1 |
| | Primary Education | 1482 | 0.200 | 0.400 | 0 | 1 |
| | Secondary Education | 1482 | 0.269 | 0.443 | 0 | 1 |
| | Tertiary Education | 1482 | 0.284 | 0.451 | 0 | 1 |
| | Graduate Education | 1482 | 0.248 | 0.432 | 0 | 1 |

**Source:** Computations of the author based on data from MSME 2016 data

From Table 2, it is evident that the MSME firms that embraced digital technology realized more sales as compared to those that had not. In addition, it is revealed that 92.8 percent of the MSMEs that have embraced digital technology have access to electricity compared to 89.6 percent of those that are not. This may be due to the fact that most digital technologies are powered by electricity and therefore the firm should be connected to the electricity supply.

## Empirical Results

**Table 2:** shows the results for regression model shown in equation

| Source | SS | Df | MS | Number of obs | = | 1,722 |
|---|---|---|---|---|---|---|
| Model | 177258.026 | 5 | 35451.6052 | F (5, 1716) | = | 11.75 |
| | | | | Prob > F | = | 0.0000 |
| Residual | 5177661.91 | 1,716 | 3017.2855 | R-squared | = | 0.0331 |
| Total | 5354919.94 | 1,721 | 3111.51653 | Adj R squared | = | 0.0303 |
| | | | | Root MSE | = | 54.93 |
| Dependent Variable | Sales | | | | | |
| | Coefficient | Standard Error | T | P>t | | |
| Digitalization | 7.277932 | 2.72695 | 2.67 | 0.008 | | |
| Access to Electricity | 5.512557 | 4.913657 | 1.12 | 0.262 | | |
| Secondary Education | 1.856261 | 3.705916 | 0.50 | 0.617 | | |
| Tertiary Education | .0931584 | 3.700969 | 0.03 | 0.980 | | |
| Graduate | 22.5455 | 4.036277 | 5.59 | 0.000 | | |
| _Constant | -4.95714 | 5.047517 | -0.98 | 0.326 | | |

**Source:** Computations of the author based on data from MSME 2016 data

The regression results shown in Table 2 indicated that firms that had embraced digitalization realize more sales than those that have not. The coefficient is statistically significant at 5 percent level of significance indicating the digitalization is important determinant of performance of MSMEs. Specifically, a firm that has adopted digital technologies realize 7.28 million more than
one that has not embraced digital technologies. These results are in line with Dimoso &Utonga (2024) and Adjabeng & Osei (2022) [2] which digital technology adoption positively impacts SME performance.

The results further revealed that firms that have access to electricity realize higher sales. The coefficient is statistically significant at 5 percent level of significance. Specifically, the results showed that a firm that has access to electricity realize KES 5.51 million per year more than one that is not connected to electricity. These results underscore the importance of electricity in boosting their performance of MSMEs.

The results revealed that MSMEs whose owners have secondary and tertiary education realize more sales than ones whose owners have primary education. However, the coefficients of secondary and tertiary education were not statistically significant. This implies that secondary and education are not important determinant of performance of MSMEs in Kenya. The results showed that coefficient of MSMEs whose owners are graduates to be positive and significant at 5 percent level of significance. Specifically, the results implied that a firm whose owner is a graduate realize KES 22.54 more in sales than one who the owner has primary school education. The results in agreement with Leiponen (2005) and Schneider *et al*. (2010) [28] which indicate highly educated entrepreneur have the potential of stimulating innovation activities in their firms thus leading to high sales turnover the study used the explanatory variables to estimate the propensity scores. The results from which propensity scores were obtained are shown in Table 3.

**Table 3: Results for generating the Propensity Scores**

| Probit regression | Number of obs | = | 2476 |
|---|---|---|---|
| | LR chi2(4) | = | 53.68 |
| | Prob > chi2 | = | 0.0000 |

| Log likelihood = -1640.9841 | | Pseudo R2 | = | 0.0161 |
|---|---|---|---|---|
| Dependent Variable: Digitalization | | | | |
| Digitalization | Coefficient | Standard Error | Z | P>z |
| Access to electricity | 0.137 | 0.091 | 1.51 | 0.132 |
| Secondary Education | 0.262 | 0.071 | 3.70 | 0.000 |
| Tertiary Education | 0.369 | 0.072 | 5.16 | 0.000 |
| Graduate | 0.494 | 0.077 | 6.43 | 0.000 |
| Constant | -0.148 | 0.092 | -1.61 | 0.107 |

**Source:** Computations of the author based on data from MSME 2016 data

From Table 3, it was established that MSMEs that have access to electricity connection are likely to embrace digital connection as compared to those not connected. In addition, the results revealed that firms whose owners have secondary education, tertiary education and are graduate are likely to embrace digital technologies in their enterprises compared to firms whose owners have primary education. This means the study should control for access to electricity, secondary education, tertiary education and graduate.

The propensity scores were obtained from above regression were used in estimating causal relationship of embracing digital technologies and the performance of MSMEs in Kenya. Specifically, the study estimated the 'Average Treatment Effect on the Treated' (ATT) with Nearest Neighbour Matching method. The results are shown in Table 4.

**Table 4:** Average Treatment Effect on the Treated' (ATT) with Nearest Neighbour Matching Method Results

| Number of Treatment | Number of control Individuals. | ATT | Standard Error | T |
|---|---|---|---|---|
| 1482 | 704 | 7.550 | 1.709 | 4.417 |

**Source:** Computations of the author based on data from MSME 2016 data

The results revealed that an MSME that has embraced digital technologies realize KES 7.55 million more than one that has not embraced digital technologies. As it is evident, the t value is greater than 2 implying that there is significant differences between MSMEs who have embraced digital technologies and those that have not. This finding conforms to economic theory. The results are also in agreement with Dimoso &Utonga (2024) and Adjabeng & Osei (2022) [2] studies which show that digital technology adoption positively impacts MSME performance. As such, this study adds to the literature by showing that digital technology is important for performance of MSMEs in Kenya.

## Conclusion and Recommendation

This study set out to investigate the effect of digital technology adoption on the performance of MSMEs in Kenya. The findings revealed that MSMEs that have embraced digital technologies earn significantly higher revenues. Specifically, a firm that has embraced digital technology realize KES 7.55 million more on average compared to a firm that has not adopted such technologies. This finding is in agreement with both economic theory and earlier empirical studies by Dimoso & Utonga (2024) and Adjabeng & Osei (2022) [2], emphasizing the positive effect digital technology adoption has on MSME performance. Overall, this study contributes to the existing literature by illustrating the transformative role of digital technology in boosting MSME performance in the Kenyan context.

Based on this finding the study makes the following recommendations. First, there is need for the government of Kenya to implement targeted programmes to support MSMEs. One of the targeted

programme is training MSMEs on how to use digital technologies. Secondly, the government should invest in a reliable internet and affordable ICT infrastructure particularly in rural areas.

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